



Whitepaper

Battery pouch cell sealing with VCSEL
heating systems

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Abstract

VCSEL heating systems provide a highly accurate sealing process and therefore can extend lifetime of battery cells, as they avoid wrinkles of the foils. This leads to higher quality and homogeneity of the pouch cells, compared to other production methods such as welding with hot bars.

Additionally, a VCSEL heating system is up to three times faster than hot bars. This increase in production speed is possible as the heat for welding is applied inside the pouch foil, close to the weld.

To guarantee that only the foil seam is heated up, the infrared radiation from the VCSEL heating system is guided through the sapphire components towards the foil seam. These sapphire components also act as clamping device.

Therefore, high quality welding results are achieved, as the clamping can be opened when the plastic of the foils is already solidified. This avoids defects of the weld seam, compared to other processes where the clamping has to be opened when the plastic is still in liquid state.

Situation

Pouch cells have highest demands in sealing quality as they have to show high density and guarantee high lifetime.

Therefore, highly accurate sealing is needed to avoid wrinkles. Wrinkle free sealing of the pouch cell foil (packaging) especially in the area of the pole connectors is needed to reach the demanded product specifications.



Figure 1:
Battery pouch cell

VCSEL heating systems for high process results

VCSEL heating systems are an extreme fast heating source that offers highly accurate processing results and homogeneous sealing profile. High process capability and repeatability are secured.

VCSEL-based sealing systems guarantee an accurate control power density through the sapphire press bars and 100% assurance that the temperature is controllable below melting point of the outer material.

The VCSEL based process also offers improved bonding force and there is no heat loss or energy waste.

With VCSEL heating systems the press can be opened very fast because the weld is cooled down by the pressing jars. So production time can be reduced significantly.

Additionally, there is a high reproducibility of the thickness of the seal. So tact time can be reduced and the actual sealing time is < 1 s.

With VCSEL heating systems also thicker electrode sealing capability is possible.

Overall, there is a high improvement of product quality, production speed and reproducibility.

Further benefits compared to hot bar technology

Further benefits can be realized with VCSEL heating systems sealing pouch cells:

- No color transformation and heat affection of the outer layer
- Higher product quality: no wrinkles and no sealing failures
- Quick exchangeable tooling interface for other sealing designs
- Flexible processing area adaption (different cell formats)
- Higher production yield
- Higher tensile strength
- Cold tooling instead of hot tooling

The solution

Combining VCSEL heating systems with customized sapphire press bars for clamping of the pouch are a perfect solution for sealing pouch cells.

The VCSEL emitters can be used to locally control the power density to adjust the heating profile of the sealing area.

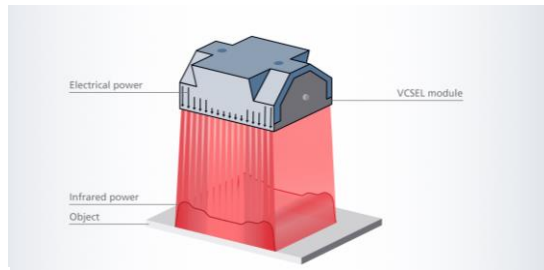


Figure 2: VCSEL heating systems with adjustable intensity profile

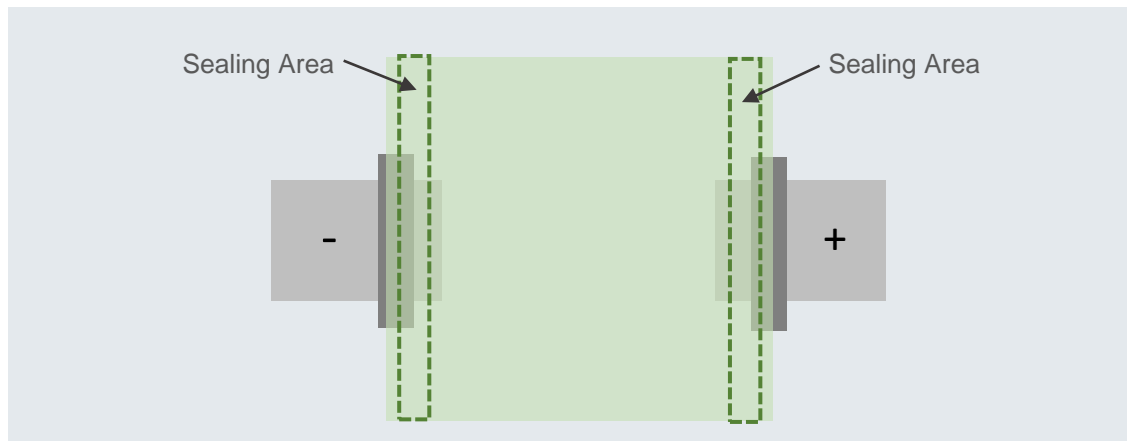


Figure 3: Top view pouch battery with sealing areas over electrodes. Heat is applied by laser radiation in the sealing area

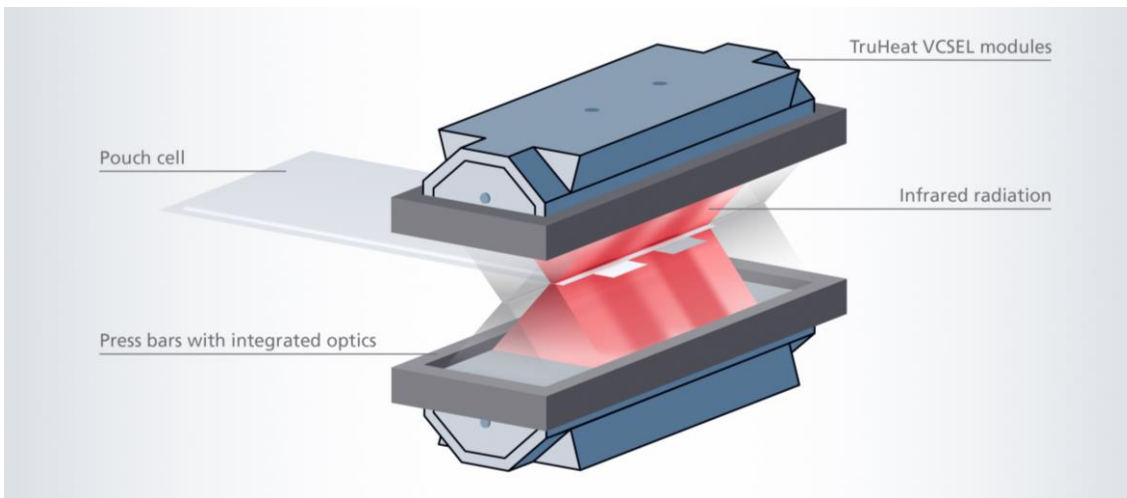


Figure 4: Detailed view of sealing area. The press bars are also used as a laser optic



Figure 5: Process result with VCSEL heating system. Wrinkle free sealing at battery contact

Conclusion

VCSEL heating systems with their characteristics of offering a highly accurate and adjustable heating profile, are a perfect match for homogeneously battery pouch cell sealing applications.

The VCSEL-based heating systems in combination with the right optics and clamping systems enable highest sealing quality while offering a fast and reliable process.



Contact us or check out more information on laser heat treatment with VCSEL heating system
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